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THESIS

A PREDICTIVE MODEL OF SURFACE WARFARE OFFICER RETENTION: FACTORS AFFECTING TURNOVER

by

Gregory D. Gjurich

March 1999

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Junior Surface Warfare Officer retention is in a crisis. The Surface Warfare Officer community anticipates an inability to fill Department Head billets due to the number of junior Surface Warfare Officers leaving military service. The goal of this study was to predict Surface Warfare Officer retention levels through the validation of a conceptual model from the Surface Warfare Community Manager's office using logistic regression and Classification and Regression Tree analysis. This study utilized data from the Officer Master File and the results from a questionnaire administered to active duty Surface Warfare Officers. Manpower analysts can use this model to predict whether certain groups of officers, with a given set of characteristics, are more likely to remain in military service.

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A PREDICTIVE MODEL OF SURFACE WARFARE OFFICER RETENTION: FACTORS AFFECTING TURNOVER

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ABSTRACT

Junior Surface Warfare Officer retention is in a crisis. The Surface Warfare Officer community anticipates an inability to fill Department Head billets due to the number of junior Surface Warfare Officers leaving military service. The goal of this study was to predict Surface Warfare Officer retention levels through the validation of a conceptual model from the Surface Warfare Community Manager's office using logistic regression and Classification and Regression Tree analysis. This study utilized data from the Officer Master File and the results from a questionnaire administered to active duty Surface Warfare Officers. Manpower analysts can use this model to predict whether certain groups of officers, with a given set of characteristics, are more likely to remain in military service.

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TABLE OF CONTENTS

I. INTRODUCTION 1

A. BACKGROUND 1

B. STATEMENT OF PROBLEM 3

1. Scope, Limitations and Assumptions 4

II. LITERATURE REVIEW 5

A. TURNOVER RESEARCH 5

B. CIVILIAN TURNOVER RESEARCH 6

C. MILITARY TURNOVER RESEARCH 9

D. SURFACE WARFARE OFFICER STUDIES 13

E. SUMMARY 14

III. METHODOLOGY 17

A. DATA 17

1. Description of OMF Database 17
2. Data Extraction 18
3. Subjects for the Questionnaire 18

B. INSTRUMENT 19

C. PROCEDURE 19

1. Data Collection for the Instrument: 19
2. Data Analysis 21

IV. RESULTS 23

A. OMF DATABASE 23

1. Sample Demographics 23
2. Analysis of the Retention Decision 24
3. Logistic Model 29
4. Classification Tree Model 31
5. Predictive Power 33

B. SURVEY DATABASE 36

1. Descriptive Statistics 37
2. Classification Tree 38

V. DISCUSSION 41

A. SUMMARY 41

B. CONCLUSIONS 44

C. POLICY IMPLICATIONS 46

LIST OF REFERENCES.....49
APPENDIX A. OMF DATA.....51
APPENDIX B. FLEET SURVEY.....53
APPENDIX C. DESCRIPTIVE STATISTICS.....61
APPENDIX D. TREE MODEL OUTPUT.....63
INITIAL DISTRIBUTION LIST.....65

LIST OF FIGURES

1. Classification and Regression Tree - OMF.....32
2. Classification and Regression Tree for Survey Data.....39

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LIST OF TABLES

1. Marsh's Explanatory Variables And Their Effects.....11
2. Retention by Designation.....25
3. Retention by Source of Commissioning.....25
4. Retention by Dependency Status.....26
5. Retention by Level of Education.....27
6. Retention by Year Group.....28
7. Retention by Race.....29
8. Logistic Model Summary.....30
9. Regression Model Prediction Summary.....34
10. Tree Model Prediction Summary.....34
11. Approximate Cost Summary Regression Model Results.....35
12. Approximate Cost Summary Tree Model Results.....36

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EXECUTIVE SUMMARY

The Navy is experiencing a shortage of highly trained Surface Warfare Officers (SWO) due to the exodus of personnel opting for civilian employment. The Navy has invested significant resources in educating and training these junior officers in the anticipation that a portion of these officers will remain until retirement. Unfortunately, the military is not meeting the projected targeted population to fulfill department head and senior leadership billets. Policy decisions relating to financial incentives, tour lengths, promotion opportunities etc., are made with the intent to maintain, if not improve, retention of quality Surface Warfare Officers. It is imperative that these decisions be based on a scientific process. Current efforts to improve the Navy's overall retention include pay increases and improvement in retirement benefits.

Most of the studies investigating turnover have pertained to civilian employees (March & Simon, 1958; Mobley, Griffeth, Hand & Meglino, 1979; Arnold & Feldman, 1982; Dreher, 1982; McEvoy & Cascio, 1985; Cotton & Tuttle, 1986; Wilcove, Burch, Conroy & Bruce, 1991). The demands and stresses placed on military personnel are different from those on civilian employees, and, consequently, the factors and characteristics identified in previous studies may not generalize to Surface Warfare Officers.

The Navy currently forecasts officer retention and attrition by extrapolating historical trends. This thesis recommends that the Navy replace the current method with two alternative statistical techniques: logistic regression and classification trees. These techniques make more accurate forecasts of SWO retention and attrition, and, thus, reduce costs by being able to better plan end-strength numbers. In addition, these

techniques more accurately identify variables that affect SWO retention. The Navy can therefore use these techniques to formulate better retention policies.

This thesis used logistic regression techniques and classification tree methodology to identify factors that affect the retention of Navy Surface Warfare Officers serving between 1990 and 1998. Data on 5,438 officers was available from the Officer Master File (OMF) maintained by the Bureau of Personnel (BUPERS). This data included only SWO Lieutenants (O-3) who had completed their initial obligated service. Attrition was modeled using the entire data set. The data was then partitioned into pieces, each containing all officers who left the service in a give year, and these were used to test the accuracy of the models.

It is difficult for any model to predict retention for a specific individual. Fortunately, the Navy in not interested so much in whether an individual leaves, but rather which groups of individuals are more prone to leaving. Both the logistic regression and classification tree models identified officers having either no dependents or only a spouse as more likely to leave, which suggests that the perception of how one's family is cared for may have a strong effect on one's decision to leave or stay. Decision-makers need to concentrate efforts on improving the quality of life of service members and their families. Variables which increased retention were commissions from Reserve Officer Training Corps (ROTC) program, and some level of postgraduate education.

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I. INTRODUCTION

A. BACKGROUND

The United States Navy is currently experiencing a retention crisis. United States Senator Trent Lott of Mississippi (Navy Times, 1998, September 7) stated, "Today, this country is not attracting and retaining enough people of the kinds needed to staff an increasingly higher-skilled force..." The Department of the Navy (1996) recognizes that the retention of eligible, qualified personnel at all levels of the organization is essential to a formidable defense structure. All branches of the military need to ensure force readiness in the near term by retaining quality people on board, maintaining sufficient accession levels to preclude a "hollow force" in the future, and managing officer accessions and retention to maintain the correct mix of grade and quality to ensure long-term readiness (Office of the Undersecretary of Defense, 1996).

The training and experience required for increasingly complex weapons systems heighten the need to maintain a stable force to preserve mission readiness. Aside from mission readiness, skilled soldiers are essential to operate and maintain these complex systems. The supervisory element – i.e., officers – requires specialized training to effectively monitor the enlisted personnel who operate the systems. Due to the complexity of military systems and the length of time required to achieve proficiency in operator skills, it is imperative to maintain a stable work force. Over the course of history, the size of the military workforce has fluctuated, which has placed pressure on military readiness and the ability to respond to a global threat. Currently, the military is experiencing a shortage of highly trained operators due to the exodus of personnel opting

for civilian employment. The military has invested significant resources in educating and training these individuals in the anticipation that a portion of these officers will remain until retirement. Unfortunately, the military is not meeting the projected targeted population to fulfill department head and senior leadership billets (Office of the Undersecretary of Defense, 1996). In order to maintain sufficient readiness levels, this study will attempt to identify the reasons why an officer decides to leave military service. These causal factors will then be integrated into a retention model to predict what classes of operators are more likely to resign from active duty military service. This retention model may assist the Chief of Naval Operations Bureau of Personnel in modifying or implementing new policies to maintain the appropriate readiness levels.

Since the early 1900s, there have been hundreds of qualitative and quantitative investigations on employee turnover (Cotton & Tuttle, 1986). These studies have found a number of factors that are attributed to civilian employee turnover. These factors include individual background and demographic factors, personal characteristics, job or career characteristics, social environmental factors at work, social environmental factors non-work related (family), organizational characteristics and practices, job performance and evaluations, internal and external economic factors, and behavioral intentions (Wilcove, Burch, Conroy & Bruce, 1991). However, the causes for civilian turnover are not the same for military employees. Previous research on military turnover found that officers' reasons for choosing to leave military service include dissatisfaction with the military lifestyle, civilian career opportunities and security, and family status (Marsh, 1989). Costs when an employee quits and those associated with the subsequent hiring of new, qualified personnel can be significant in both civilian and military settings. Therefore, it

is paramount that an organization maintains the appropriate manning levels and a highly trained work force to ensure productivity and safety.

duMont (1997) conducted a fleet-wide survey by mail, analyzing the primary causes of junior Surface Warfare Officer (SWO) turnover. His goals were to uncover factors with which junior SWOs were dissatisfied, correlate career intentions with these factors, and determine what the internal labor market is within the Navy for SWOs. duMont concluded that the distinguishing characteristics between those who would resign and those who would transfer laterally were lower satisfaction with "Navy leadership" and with "quality of family life." Those who intended to make the Navy a career possessed a proclivity toward a military lifestyle as opposed to a specific set of descriptive characteristics. The current study will attempt to take this methodology one step further by predicting the number of years an individual possessing certain characteristics will remain on active duty.

B. STATEMENT OF PROBLEM

The purpose of this study is to analyze factors such as an attractive civilian economy, the inability to plan the demands of a hectic surface warfare lifestyle, and family separation identified by the SWO community manager (B. Sorce, personal communication, October 1998) using data from the Officer Master File (OMF) database and from a questionnaire distributed to active duty Surface Warfare Officers (SWOs). This study will determine which factors best characterize junior SWOs that are leaving the Navy. This study will then utilize these characteristics in a regression model, which will better predict the retention of junior officers to aid decision-makers in forming policy affecting junior SWO retention. This study utilized the framework developed from a

similar set of studies of naval aviator retention conducted at the Naval Postgraduate School Department of Operations Research, Monterey, California (Poindexter, 1998; Sullivan, 1998).

1. Scope, Limitations and Assumptions

Data for the Officer Master File (OMF) database was limited to Lieutenants (O-3) serving in the U.S. Navy between 1990 and 1998. Only those officers who had completed their initial obligated service were included in the study.

The assumption used for the logistic model was that the Type II error – to predict that a member will stay and he or she, in fact, leaves – is more costly than a Type I error – predicting a member will leave when he or she actually stays. This is because retention goals cannot be met when the officer leaves unexpectedly, but planned shortfalls can be filled when an officer stays unexpectedly.

II. LITERATURE REVIEW

A. TURNOVER RESEARCH

Price (1979) defines turnover as the degree of individual movement across the membership boundary of a social system, while Pearson (1995) defines turnover as "the leaving behavior of employees when they sever their association with the organization." In either definition, turnover is concerned with movement. The concern with movement often results in turnover being referred to as a "process" type of concept as opposed to a structural concept such as complexity and centralization.

Employee turnover has received a great deal of attention within industrial and organizational psychology. Since the early 1900's there have been hundreds of qualitative and quantitative investigations of turnover (Cotton & Tuttle, 1986). Turnover can further be classified as voluntary or involuntary (McEvoy & Cascio, 1985). Previous retention studies have been inconsistent on the operational definition for voluntary and involuntary turnover, which has led to a variety of findings for the causal factors of employee turnover (Mobley, Griffeth, Hand & Meglino, 1979). These factors include individual background and demographic factors, personal characteristics, job/career characteristics, social environmental factors at work, social environmental factors non-work (family), organizational characteristics and practices, job performance and evaluations, internal and external economic factors, and behavioral intentions (Wilcove, Burch, Conroy & Bruce, 1991). For the purposes of this paper, voluntary turnover will be defined as turnover initiated by the individual, as opposed to involuntary turnover which is initiated by the organization -- i.e. separated, failed-to-select, and fired.

B. CIVILIAN TURNOVER RESEARCH

Organizations invest huge resources in their employees in the form of training, salaries and benefits. Costs when an employee quits and those associated with the subsequent hiring of new, qualified personnel can be significant (Lee & Mitchell, 1994). Early retention work by March and Simon (1958) serves as a major underpinning of literature on voluntary employee turnover. They proposed that turnover results from an individual's perception about desirability of movement from the organization ("satisfaction") and their perception of the ease of movement to a new job ("alternatives"). These would be classified as "orientations" toward the organization. The individual's decision to leave the organization depends upon the interaction of these two components.

Job satisfaction is determined by the individual's perceived "fit" within the organization, the predictability of job relationships, and the compatibility of the job and other roles. The perception of alternatives is a function of the number of organizations visible to the individual and the personal characteristics of the individual (March & Simon, 1958). The work of Price is in conflict with March and Simon's propositions. He claims accessions and separations are illustrations of "behavior" rather than orientations (Price, 1979). Turnover, says Price, must clearly be distinguished from such orientations as satisfaction, alienation, and motivation. He further states that satisfaction is more often confused with turnover than either alienation or motivation. Many researchers, he claims, mistakenly use turnover as a measure of satisfaction. Individuals who leave an organization are commonly dissatisfied with the organization or with some of its aspects.

However, not all individuals who leave are dissatisfied, and not all dissatisfied employees leave. Turnover and satisfaction can vary independently of each other (Price, 1979).

Mobley, Griffeth, Hand, and Meglino (1979) conducted a comprehensive literature review and found that age, tenure, overall satisfaction, job content, intentions to remain on the job, and organizational commitment are consistently and negatively related to turnover. However, less than 20 percent of the variance in turnover is explained with just these variables – i.e. over 80% comes from somewhere else. They contend that lack of a clear conceptual model, failure to consider job alternatives, insufficient multivariate research, and infrequent longitudinal studies are factors precluding a better understanding of the psychology of the employee turnover process. These findings are in agreement with the results of March and Simon (1958).

Mobley, et al. (1979) developed a conceptual model of turnover that suggests that employee turnover and withdrawal is affected by satisfaction (present oriented), attraction of expected utility of current role (future oriented), and attraction of expected utility of alternative roles. Their approach rests on the belief that turnover is an individual choice behavior. They also contend that intention to quit is considered the immediate precursor of turnover and therefore, the best predictor of turnover. Intention to search for an alternative job is also of particular interest. Unfortunately, Mobley et al., (1979) did not validate their finding with data; rather the finding was based on a meta-analysis of previously published retention studies.

Arnold and Feldman (1982) developed a multivariate model to analyze the turnover process of 654 accountants. They measured demographic variables, tenure, multiple measures of job satisfaction and organizational commitment, perceived job

security, intention to search for an alternative position, perceived existence of alternative positions, and intention to change positions. They also examined the relationship between intention to change jobs and actual turnover behavior, the interrelationships of intention to search for a new position, intention to change positions, perceived existence of alternatives, and actual turnover behavior, and finally the determinants of intentions to search for alternatives and intentions to quit. They found that turnover was significantly influenced by age, tenure, overall job satisfaction, organizational commitment, perceived job security, and intention to search for an alternative. Moreover, turnover behavior was strongly related to intentions to search for alternative jobs than to change positions. The most glaring weakness of the Arnold and Feldman study is the question of external validity - whether the results will generalize to other populations.

Dreher (1982) examined whether turnover is linked to the performance level of employees who decide to leave. He examined the performance, potential, aptitude, and career advancement differences between employees who voluntarily resigned from a national oil company and those who continued in the organization. Dreher postulated that the relationship between voluntary turnover and performance is a function of two variables: the first concerns organizational reward systems, and the second focuses on the employer's ability to evaluate the employee effectively. He found (1) no evidence that better performers left more often than poorer performers; (2) small, systematic differences associated with early career measures of performance, aptitude, and potential; (3) performance differentials increasing with tenure in the organization; and, obviously (4) stayers were promoted at higher rates than leavers. Dreher did caution, however, that

these results pertained to a particular organization and that further study is required in the role of performance as a determinant and consequence of voluntary turnover.

C. MILITARY TURNOVER RESEARCH

Military turnover may involve a different process than civilian withdrawal because of dissimilar structural relations among turnover causes (Hom, Caranikas-Walker, Prussia & Griffeth, 1992). Derr (1980) approached the officer retention question using the concept of "career anchors." Typically, a soldier signs a contract that will obligate employment for a specified number of years in active duty military service. This contract is different between the enlisted and officer corps, and the length of the contract may vary within each warfare specialty. At the end of this contractual agreement, the military soldier may renew the contract or be requested to leave active duty service. Derr believed that a member's decision to leave military service depended upon the length of service. Derr stated that length of service could be categorized into separate time intervals that corresponded to career path progression. The metaphor of an anchor connotes composite needs, values, attitudes, and abilities of an individual that tie one to a certain kind of work history or career. It is in this way that the individual develops a "fit" with the organization. Derr postulated that a service member's early career (1-5 years) was a period of mutual study and discovery between employee and employer. Between the fifth and tenth year, the employee gains a clearer picture of how and where he fits into the organization. It is through the development of the employee's perceived fit in the organization that he will base his decision to stay or leave.

Marsh (1989) used data from the *1985 DoD Survey of Officers and Enlisted Personnel* to predict retention behavior. Multiple regression analysis revealed that the

most important causes of retention intentions were months of active duty, the highest pay grade one expects to reach before leaving the Navy, and satisfaction with the military way of life.

Marsh developed a causal model that accounts for the development of emotional commitment and attitudes toward the military. His model states that a duty history, characterized by educational level, length of service, present duty location, and accumulated amount of sea time, can be constructed for any Naval officer. He also claims that an individual has various expectations concerning duty locations, future promotion, eventual highest pay grade, etc., and that Naval officers vary in family status, raising issues of the relationship between commitments to the Navy and commitments to family. Duty history, expectations and family status influence how satisfied one is with the military way of life. Satisfaction, of course, has significant effects on retention. This approach is a more realistic assessment of the development of how intrinsic satisfiers influence the individual than the career anchor concept used by Derr.

Marsh constructed a dependent variable from a survey question that asked respondents, "When you finally leave the military, how many total years of service do you expect to have?" He used the expected years of service (EXPYOS) as his dependent variable. Table 1 lists the explanatory variables and their effects on EXPYOS.

Table 1: Marsh's Explanatory Variables And Their Effects

VARIABLE	VARIABLE DEFINITION	EFFECT ON EXPYOS
EDUC	Highest grade or year of school or college credited	no significance
MAD	Months of Active Duty	positive**
PAYGRADE	Current pay grade	positive*
MOPRLOC	Number of months at present duty location	negative**
REMOLOC	Number of months remaining at current duty location	no significance
MOSEA	Accumulated months of sea time	positive*
MOSEP	Number of months separated from spouse/family in last year	no significance
AGCAREER	How well spouse and member agree on career plans	positive**
FAMCIV	Family would be better off if member had civilian job	positive**
FEELINC	Satisfaction with family income	no significance
EXPGRADE	Highest expected pay grade	positive**
CHNXPROM	Chances of being promoted to next pay grade	negative**
NXTUND	Chances that next duty station will be undesirable location	no significance
CONTED	Extent to which PCS is a problem to continuing education	negative**
SERVEUS	Satisfaction with opportunity to serve country	positive**
JOBSAT	Satisfaction with current job	positive**
RETBEN	Satisfaction with retirement benefits	positive**
MILSAT	Overall satisfaction with military life	positive**
FINDCIV	Likelihood of finding civilian job	no significance

* Significant at the 0.05 level

** Significant at the 0.01 level

Source: Marsh (1989) pp. 4 - 18

One may conclude that the most important effects on expected years of service are months of active duty and the highest expected pay grade one expects to attain. Worth noting is the significantly negative effect that an officer's perception of his or her chances of being promoted to the next higher pay grade has on expected years of service. One may conclude that this may be due to the perceived constriction of promotion as an officer ascends through the ranks. Even controlling for the effects of months of active duty, current pay grade and expected highest pay grade, the total expected time an officer

expects to remain on active duty is longer when he or she is satisfied with the military as a way of life (Marsh, 1989).

Ashcraft (1987) used the *1985 DoD Officer and Enlisted Personnel Survey* to analyze junior unrestricted line naval officers' attitudes about a military career choice. He used a multivariate regression analysis to explain junior officer career orientation with demographic variables, tenure-related variables, orientation variables, perception of external job opportunity variables and family financial resource variables. Ashcraft found that the factors that influence junior officers' career decisions to remain in service beyond their initial obligation are the amount of time spent on sea duty, the perceived probability of finding a civilian job, satisfaction with pay and allowances, satisfaction with current military job, satisfaction with job training, and satisfaction with working conditions.

A more recent issue possibly affecting the career decisions of military officers is the continuing downsizing effort within the Department of Defense. The end of the Cold War forced the military to reexamine its roles, missions and force structure. Wong and McNally (1994) surveyed 52 middle-grade Army officers' attitudes concerning the recent military downsizing and how that affects military readiness. The objective of the survey was to measure organizational commitment, perceived effectiveness of the Army's communication, and the officer's perceptions of incentives to leave the Army. Concerns revolved around the Army "breaking faith" and violating its informal contract, how career paths in the future would be determined, and the treatment of soldiers during the downsizing effort.

The officers reported a weakening of the psychological contract with the Army – the belief a job well done would be rewarded with job security and satisfactory benefits –

as a direct result of downsizing. In addition, Wong and McNally (1994) found a significant decrease in organizational commitment following the beginning of the downsizing effort. However, the officers believed that the Army was being open and honest about the objectives of the force reduction plan and had every intention to monitor the soldiers' welfare to ensure a smooth transition to civilian employment.

D. SURFACE WARFARE OFFICER STUDIES

Since the 1960s, the retention of junior SWOs has been a problem (from duMont, 1997, pg. 25). In 1979, the Navy commissioned several studies on the SWO retention problem which concentrated on initial assignments, junior officer spouses, personal qualifications, and the career decision process.

Holzbach and Morrison (from duMont, 1997, pg. 25) concentrated on junior officers and found that the detailing process -- from interaction with the detailer to the timing of issuance of orders -- has a negative effect on a junior officer's career decision. In an effort to examine the effect of a spouse on the military member, Holzbach and Morrison conducted a similar study using surveys and personal interviews to measure spouses' attitudes on whether a military career was good for the family. They found that spouses who worked within the home were more supportive of a Naval military lifestyle than those who worked outside the home (from duMont, 1997, pg. 26). In 1983, the Navy focused on the relationship between career intentions and the professional development of junior SWOs (Cook & Morrison, 1983). Researchers concluded that career intent expressed by junior SWOs one to two years prior to completion of the minimum service requirement (MSR) is the best single predictor available to forecast whether the officers will continue their career beyond their MSR. JO's career decisions

are influenced by their first sea tour experiences, perceptions of working environment, and professional development opportunities.

Most recently, duMont (1997) conducted a survey on both active duty SWOs and reservists. He concludes that one's personality characteristic is what drives whether a SWO intends to stay in the military until retirement – i.e. a "taste for military life." On the other hand, those officers who intended to leave were dissatisfied with the "quality of family life" and "Navy leadership." They believed the only way to improve their situation was to leave active duty. Interestingly, those officers who intended to transfer laterally did not differ in their satisfaction with "quality of family life"; it was their dissatisfaction with "job enjoyment" that played the greatest role in their decision to switch communities. It is also interesting to note that there was not a significant difference in satisfaction with "total pay" between those who planned to stay on active duty and those who intended to leave. (duMont, 1997) His regression model supports the work of Marsh (1989) -- the longer one stays in the military, the lower his or her perceived likelihood of command.

E. SUMMARY

The findings of previous research support the contention that monetary factors are not the major determinant in an officer's decision of whether or not to stay in the military. An individual's concern about his or her long-term opportunities in an organization was consistently mentioned in these studies and was statistically significant whenever analyses were performed. In particular, the military's force drawdown and the threat to job security as a result of that draw-down has come to the fore as a major factor in turnover decisions.

Personnel data from the Officer Master File was analyzed to determine the characteristics that best describe SWO lieutenants who have just completed their initial term of obligated service and were faced with the decision to leave or stay in the military. Variables examined were an officer's race, sex, source of commissioning, level of education, designation, year group and dependent status. These were then compared with the results of a survey administered to junior SWOs which will measure less tangible factors such as satisfaction with job, military lifestyle, pay and benefits and career opportunities. It is expected that the decision to leave military service is not a function of monetary consideration, but of a perception that a non-military lifestyle provides better career opportunities and a more stable home life, as indicated by previous studies of the effects of intrinsic factors on the decision to leave an organization.

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III. METHODOLOGY

Two methods from studies on aviator officer retention (Poindexter, 1998; Sullivan, 1998) – logistic regression and classification tree – were utilized to examine the conceptual models of Surface Warfare Officer (SWO) community manager. First, the Officer Master File (OMF) database was analyzed to determine whether factors on which the SWO community is basing decisions are indeed the factors affecting retention. This provides a historical perspective utilizing data that actually indicates the number of SWOs attriting. Second, the results from a questionnaire distributed to active duty SWOs were analyzed to see which factors are important to current community members and to see the predictive capabilities of these factors.

A. DATA

1. Description of OMF Database

This database, maintained by BUPERS, contains 311 fields of information on every officer in the Navy and Naval Reserve. Records are indexed by social security number and individual fields are organized into broad categories (BUPERS, 1994). The OMF includes detailed information on the service member's current assignment, surface community related information, dependency data, initial entry information, personal demographic information, promotion information, separation codes, service school information, and specialty skill codes (Poindexter, 1998).

2. Data Extraction

The Defense Manpower Data Center - West (DMDC-West) provided the data for this analysis. The data consists of SWOs serving between 1990 and 1998 in the active duty U.S. Navy, and active duty U.S. Naval Reserve. Because the SWO community manager expressed the belief that the problem is with junior officers, only Lieutenants (O-3) who completed their initial obligated service were considered. Comparisons of pairs of consecutive years were analyzed to determine when a member first left the service. For example, if a record appeared in 1993 but not in 1994, that member was classified as a "leaver" in 1993. Likewise, to determine whether or not a member remained in service, if he first appeared in 1993 and then again in 1994, he or she was classified as a "first-time stayer" in 1994 and was not considered again in subsequent years. This procedure resulted in 5,438 records between 1991 and 1998 indexed by social security number.

3. Subjects for the Questionnaire

Active duty SWOs of designators 116X and 114X, as well as undesignated junior officers (11XX), stationed aboard ships in the Atlantic and Pacific fleets and at the Surface Warfare Officer School in Newport, Rhode Island volunteered for this study. Deployed officers were excluded for expediency.

There are approximately 3900 SWOs assigned to ships. Of these, 1700 were provided questionnaires. Of the 900 SWOs attending school in Newport, RI, 300 were provided questionnaires.

B. INSTRUMENT

1. For SWOs on ships and at school

A four-page (front and back) questionnaire was developed to measure factors that affect job satisfaction and ultimately retention. The questionnaire can be found in Appendix B. This questionnaire, patterned after the DoN 1992 Survey of Officers, was divided into the following six categories: Individual Characteristics; Military Information; Present and Past Locations; Career Intent; Military Compensation, Benefits and Programs; and Military Life. The Individual Characteristics section consisted of multiple choice questions that provided demographic information. Military Information consisted of multiple choice and yes/no questions that provided statistics on an individual's current military status. The remaining sections consisted of Likert-scaled responses and categorical responses to determine attitudes about satisfaction and agreement with various aspects of a military lifestyle.

C. PROCEDURE

1. Data Collection For the Instrument

The goal of this portion of the data collection was to minimize the impact of time and effort to the fleet required completing the forms. After completion, subjects returned the information to the individual distributing the questionnaire who then mailed it back to NPS.

a. For SWOs on Ships and at School

A package of twenty-five questionnaires and twenty-five Scantron forms (number F-165) was provided to each unit surveyed. Each package also contained a self-

addressed, stamped envelope in which the units were to return the completed questionnaires.

b. Pacific Fleet

Thirty-three ships were visited at the San Diego Naval Station. The Executive Officers (XOs) of these ships were hand-delivered the packages described above with an instruction letter on how the questionnaires should be administered to the potential respondents. The author was available for any questions the XOs might have had. In addition, five packages were mailed to ships homeported in Pearl Harbor, Hawaii.

c. Atlantic Fleet

Four Chief of Staff Officers of squadrons at Norfolk Naval Station were provided packages appropriate for the number of ships under their cognizance. Collectively this amounted to twenty-four packages. Twenty packages were also provided to the group headquarters at the Little Creek Naval Amphibious Base also in Norfolk, Virginia.

The individuals receiving the packages were encouraged to allow respondents to complete the questionnaires on their own time. Group interaction was discouraged. Those individuals distributing questionnaires were also instructed to concentrate on the junior personnel if enough questionnaires were not available in the package.

2. Data Analysis

a. Logistic Regression

Logistic regression explains a dependent variable by a linear combination of independent variables. For this analysis the dependent variable is categorical (i.e., whether or not an officer leaves the service), and the goal is to determine the probability an officer with a given set of characteristics will attrite. Data from the OMF database was modeled using a logistic, or logit, regression. A logistic, or logit, regression results in "predictive values which correspond to the probability of a positive (attrition) outcome" (Martin, 1995). The model for logit regression is:

$$\text{Prob}(Y_{ij} = 1 \mid \mathbf{X_j}) = 1/(1+\exp(-\mathbf{X_j}\beta)$$

where Y_{ij} is the dependent variable for the i^{th} category and the j^{th} member, $\mathbf{X_j}$ is the vector of independent variables for the j^{th} member, and β is the vector of regression coefficients.

Using S-Plus (Mathsoft, Inc., 1995) the OMF data were modeled using logit regression. Appendix B shows the summary counts for each year grouping broken down by factor response. The first step was to build a model that included all potential predictors. The magnitude of the t-values was computed and the variable corresponding to the smallest of these was deleted if its t-value was insignificant at $\alpha = 0.05$. This process was repeated until all remaining t-values were significant.

b. Classification Tree

Tree based models are an exploratory technique to uncover structure in data and are an alternative to logistic models for classification or regression problems. Classification trees are similar to regression in that they model a categorical dependent

variable, Y_k, by a vector of independent variables, $\mathbf{X_i}$, for member *i*. The result of a classification tree is a determination of a most probable level of the dependent variable. The resulting tree's terminal nodes or "leaves" contain groups of cases with similar values of their independent variables and, it is expected, similar values for the dependent variable. (Poindexter, 1998)

The classification tree begins with a parent node – the entire data set. S-PLUS will then determine the split of the data that reduces the sum of the squared residuals after looking at every variable and every possible binary split of the variables. Recursively, S-PLUS will evaluate each child-node and continue splitting the data until it becomes infeasible to continue. The result is a huge tree that must be "pruned" by the analyst to determine the best predictive value of the tree.

The OMF data and questionnaire data have both been analyzed using this method, and the resulting models were compared with both the conceptual models and the models derived from the logit regression.

IV. RESULTS

These results for the OMF database are presented in a manner consistent with a previous study by Poindexter (1997). A logistic regression and classification tree was performed on this data. The survey database had a small response rate (~14 percent) and was not a simple random sample. A classification tree was created on this data to determine which characteristics could be compared to the OMF database.

A. OMF DATABASE

1. Sample Demographics

Of the 5,438 officers included in the sample, 3,921 (72%) were designated regular Navy (1110/1140), 1,247 (23%) were Reservists, and 270 (5%) were trainees such as officers who are working toward qualification as a Surface Warfare Officer (SWO). The Naval Academy granted commissions to 1,759 (32%) of the sample population, while ROTC and OCS commissioned 2,450 (45%) and 968 (18%) respectively. The remainder received their commissions from other sources, e.g., direct commissions.

There were 2,132 (39%) single officers in the sample and 1,813 (33%) married ones, of which, 96 (5%) had a military spouse. A large number, 1493 (27%) had a spouse and children. The sample was well educated. Only 15 (0.3%) had no bachelor's degree while 5,112 (94%) had no more than a bachelor's degree. A small amount, 311 (6%) had at least begun postgraduate work. Year groups represented ranged from 1980 to 1993. The early year groups, 1980 through 1984, averaged less than one percent of the total sample size. The middle years, 1985 through 1989, increased, on average, four percent a year with a peak of 954 (18%) officers in 1988. In 1990 the number decreased

to 462 (8%) and stayed close to that level until 1993 when the number dropped to 288 (5%).

The vast majority, 4,780 (88%), was Caucasian while the remaining 658 (12%) were African, Native, or Asian American or other. Nearly all, 5,292 (97%), of those sampled were male, and 146 (3%) were female. Geographic locations of their duty stations were not available for all of the year groups and consequently were not considered for this study. All of the sample demographics are summarized in tables in Appendix C.

2. Analysis of the Retention Decision

Among the demographic variables, the following were selected for subsequent analyses: designator, source of commissioning, dependent status, level of education, year group and race. Table 2 displays a cross tabulation of designation and retention. There were 1,247 (23%) Reservists in the sample, and 687 (55%) of those left the Navy Reservists and Trainees were the most likely to separate, whereas Regular Navy 1110's accounted for 3,835 (71%) of the sample but accounted for only 1,340 (59%) of those leaving the Navy. In each block of the table, the two numbers represent the total number of officers in that block and percent of column total. S-Plus was used to calculate Pearson's Chi-square (χ^2) statistic to test for independence of the rows and columns in Table 2. A χ^2 test value of 281.5 was obtained, and it was found to be "significant" at the p-value of p=.01. A significant p-value ($p<0.01$) allows one to reject the null hypothesis that the rows and columns are statistically independent.

Table 2: Retention by Designator

DESIGNATOR		LEAVE	STAY	TOTAL
1110	n	1340	2495	3835
	%column total	58.93%	78.86%	70.52%
1140	n	69	17	86
	%column total	3.03%	0.54%	1.58%
TRAINEE	n	178	92	270
	%column total	7.83%	2.91%	4.97%
RESERVIST	n	687	560	1247
	%column total	30.21%	17.70%	22.93%
Column Total		2274	3164	5438

Naval Academy graduates made up 1,759 (32%) of the sample population and 591 (26%) of the "leavers". Officers who received their commissions from Reserve Officer Training Corps (ROTC) made up the bulk of the officer base with 2,450 (45%), and made up 960 (42%) of the "leavers." Officer Candidate School (OCS) graduates made up 968 (18%) of the sample population and 592 (26%) of the "leavers". Table 3 displays a cross-tabulation of source of commissioning and retention. The rows of the table reflect commissioning sources, whereas the first column, "STAY", is all officers who remained in the Navy; the "LEAVE" column contains those officers who did not. A χ^2 test value of 212.2 was obtained, and it was found to be "significant" at the p-value of p=.01). A significant p-value ($p<0.01$) allows one to reject the null hypothesis that the rows and columns are statistically independent.

Table 3: Retention by Source of Commissioning

COMMISSIONING SOURCE		LEAVE	STAY	TOTAL
Academy	n	591	1168	1759
	%column total	25.99%	36.92%	32.35%
ROTC	n	960	1490	2450
	%column total	42.22%	47.09%	45.05%
OCS	n	592	376	968
	%column total	26.03%	11.88%	17.80%
OTHER	n	131	130	261
	%column total	5.76%	4.11%	4.80%
Column Total		2274	3164	5438

Officers with no dependents made up the largest number of records, 2,132 (39%), in the sample population and 885 (39%) of those leaving. Married officers with no children were the next most likely to leave, making up 1,813 (33%) of those in the sample and 735 (32%) of those leaving. Table 4 displays a cross-tabulation of dependent status and retention. In each block of the table, the two numbers represent the total number of officers in that block and percent of column total. S-Plus was used to calculate Pearson's Chi-square (χ^2) statistic to test for independence of the rows and columns in Table 4. A χ^2 test value of 3.7 was obtained, and it was not found to be "significant" at the p-value of p=.16). A significant p-value ($p<0.01$) allows one to reject the null hypothesis that the rows and columns are statistically independent. With this p-value, one can not conclude that the variables are dependent.

Table 4: Retention by Dependency Status

DEPENDENT STATUS		LEAVE	STAY	TOTAL
No Dependents	n	885	1247	2132
	%column total	38.92%	39.41%	39.21%
Spouse Only	n	735	1078	1813
	%column total	32.32%	34.07%	33.34%
Dependents	n	654	839	1493
	%column total	28.76%	26.52%	27.45%
Column Total		2274	3164	5438

Of the 15 (.28%) officers with no college degree, the majority, 11 (73%) left the Navy. This group is so small, however, and has little weight throughout the analysis. The bulk of the officers, 5112 (94%) possessed a bachelor's degree; however, 311 (~6%) of the officers pursued postgraduate education and made up 236 (10%) of those leaving. Table 5 displays a cross tabulation of level of education and retention. The rows of Table 5 reflect the levels of education; the first column, "STAY", is all officers who remained in the Navy. The second column, "LEAVE", contains those who did not. A χ^2 test value

of 164.3 was obtained, and it was found to be "significant" at the p-value of p=.01. A significant p-value ($p<0.01$) allows one to reject the null hypothesis that the rows and columns are statistically independent.

Table 5: Retention by Level of Education

LEVEL OF EDUCATION		LEAVE	STAY	TOTAL
No Degree	**n**	11	4	15
	%column total	0.48%	0.13%	0.28%
Bachelors	**n**	2027	3085	5112
	%column total	89.14%	97.50%	94.01%
Postgraduate	**n**	236	75	311
	%column total	10.38%	2.37%	5.72%
Column Total		2274	3164	5438

Year groups 1986, 1987 and 1988 had the highest numbers of leavers – 255 (11%); 332 (15%); 415 (18%), respectively. This can be because the first opportunity that these officers had to leave the military was after the Gulf War. Table 6 displays a cross tabulation of year group and retention. In each block of the table, the two numbers represent the total number of officers in that block and percent of column total. A Pearson's Chi-square (χ^2) test could not be performed because the entries in a number of cells were too small (<5).

Table 6: Retention by Year Group

YEAR GROUP		LEAVE	STAY	TOTAL
1980	n	1	0	1
	%column total	0.04%	0.00%	0.02%
1981	n	1	1	2
	%column total	0.04%	0.03%	0.04%
1982	n	2	1	3
	%column total	0.09%	0.03%	0.06%
1983	n	4	2	6
	%column total	0.18%	0.06%	0.11%
1984	n	3	2	5
	%column total	0.13%	0.06%	0.09%
1985	n	133	197	330
	%column total	5.85%	6.23%	6.07%
1986	n	255	344	599
	%column total	11.21%	10.87%	11.02%
1987	n	332	492	824
	%column total	14.60%	15.55%	15.15%
1988	n	415	539	954
	%column total	18.25%	17.04%	17.54%
1989	n	325	484	809
	%column total	14.29%	15.30%	14.88%
1990	n	193	269	462
	%column total	8.49%	8.50%	8.50%
1991	n	227	338	565
	%column total	9.98%	10.68%	10.39%
1992	n	257	333	590
	%column total	11.30%	10.52%	10.85%
1993	n	126	162	288
	%column total	5.54%	5.12%	5.30%
Column Total		2274	3164	5438

The majority, 4,780 (88%), of the sample was Caucasian and made up the bulk, 2,029 (89%), of the leavers. Table 7 displays a cross tabulation of race and retention. The rows of Table 7 reflect dependent codes. A χ^2 test value of 6.5 was obtained, and it was not found to be "significant" at the p-value of p=.011). A significant p-value (p<0.01) allows one to reject the null hypothesis that the rows and columns are statistically independent. With this p-value, one can not conclude that the variables are dependent.

Table 7: Retention by Race

RACE		LEAVE	STAY	TOTAL
Caucasian	n	2029	2751	4780
	%column total	89.23%	86.95%	87.90%
Non-Caucasian	n	245	413	658
	%column total	10.77%	13.05%	12.10%
Column Total		2274	3164	5438

3. Logistic Model

A logistic regression was run with "LEAVE" or "STAY" as the predictor variable and the following response variables: designation, source of commissioning, dependent status, level of education, year group and race. Table 8 summarizes the resulting logistic model. To test the null hypothesis that all **X** variables' coefficients are zero, one can compare the difference between the null deviance and the residual deviance to a χ^2-distribution with 12 degrees of freedom (Hamilton, 1992). A χ^2 (12) has an expected value of 12 and a standard deviation of 3.464. This approximation shows that the model is significant at a high confidence level (7,392.351-6,789.255= 603.096). The probability of a greater χ^2, with 12 degrees of freedom (the final model includes 12 more parameters than the intercept-only model), is p<.01. One rejects the null hypothesis that coefficients

on all 12 variables are zero (Hamilton, 1992). A baseline level for each of the variables was created to compare with the other levels. The following were used as the baseline for the logistic regression model: Designation - 1110; Commission - Academy; Dependent Status - with Dependents; Education - Bachelor's degree; Race - Caucasian.

Table 8: Logistic Model Summary

Variable	Level	Value	Std Error	t-value
Intercept		1.52	1.14	1.33
Designation	**1140**	-2.03	0.28	-7.38
	Trainee	-1.28	0.14	-9.37
	Reservist	-0.81	0.07	-11.66
Commission	**ROTC**	-0.29	0.07	-4.23
	OCS	-0.87	0.09	-9.89
	OTHER	-0.64	0.14	-4.43
Dependent Status	**No Dependents**	0.02	0.07	0.22
	Spouse Only	0.02	0.08	0.2
Education	**No Degree**	-1.02	0.6	-1.69
	Post Graduate	-1.7	0.14	-12.05
Year Group		0	0	-0.46
Race	**Non-Caucasian**	0.21	0.09	2.37

The resulting equation is:

$$\text{logit}\ (\Pr(Y)_i) = \mu + \alpha_i + \beta_i + \gamma_i + \delta_i + \lambda_i$$

where $(Y)_i$ is the dependent variable, attrition, for the member i; μ is the intercept; α is the value of the designation of member i (0 if Designation "1110"); β is the value of the commissioning source of member i (0 if commission source "Academy"); γ is the value of the dependent status of member i (0 if status is "Dependents"); δ is the value of the education level of member i (0 if education level is "Bachelor's"); and λ is the value of race of member i (0 if race is "Caucasian"). For example, an officer who is designated 1110, commissioned through ROTC, has no dependents, has no degree, and is Caucasian;

the logit(Pr(Yi)) = 1.52 + (0) – 0.29 + 0.02 – 1.02 + (0) = 0.23; the probability that the officer will leave is therefore $\frac{1}{1+\exp(-.23)} = .443$.

In summary, designators 1140, Reservists and Trainees decrease the probability of attrition compared to designator 1110; source codes ROTC, OCS and OTHER decrease the probability of attrition as compared to the Academy category. Finally, some postgraduate education decreases the likelihood of attrition as compared to possessing a bachelors degree. In contrast, military members with no dependents (NODEP) or with a spouse only are more likely to attrite than those members with children. Other variables were removed from the model due to insignificance. Previous research (Zinner, 1997) indicates that officers graduating from the Naval Academy or from Reserve Officer Training Corps (ROTC) would be more likely to remain in service. This study supports Zinner's claim that ROTC graduates would be more likely to remain in service, but does not support the claim for Academy graduates.

4. Classification Tree Model

Classification and regression tree (CART) analysis was used to create a classification tree using "LEAVE" or "STAY" as the predictor variable and the following response variables: designation, source of commissioning, dependent status, level of education, year group and race. Random 10-fold cross-validation identified an optimal tree size of 10 terminal nodes (S-Plus 4 Guide to Statistics). The number of nodes is based on the smallest deviance associated with that size. Figure 1 depicts the CART model.

The number inside each node is the probability of staying expressed as a percentage, and the number below the node is the number of observations in that node. The code for this tree can be found in Appendix E.

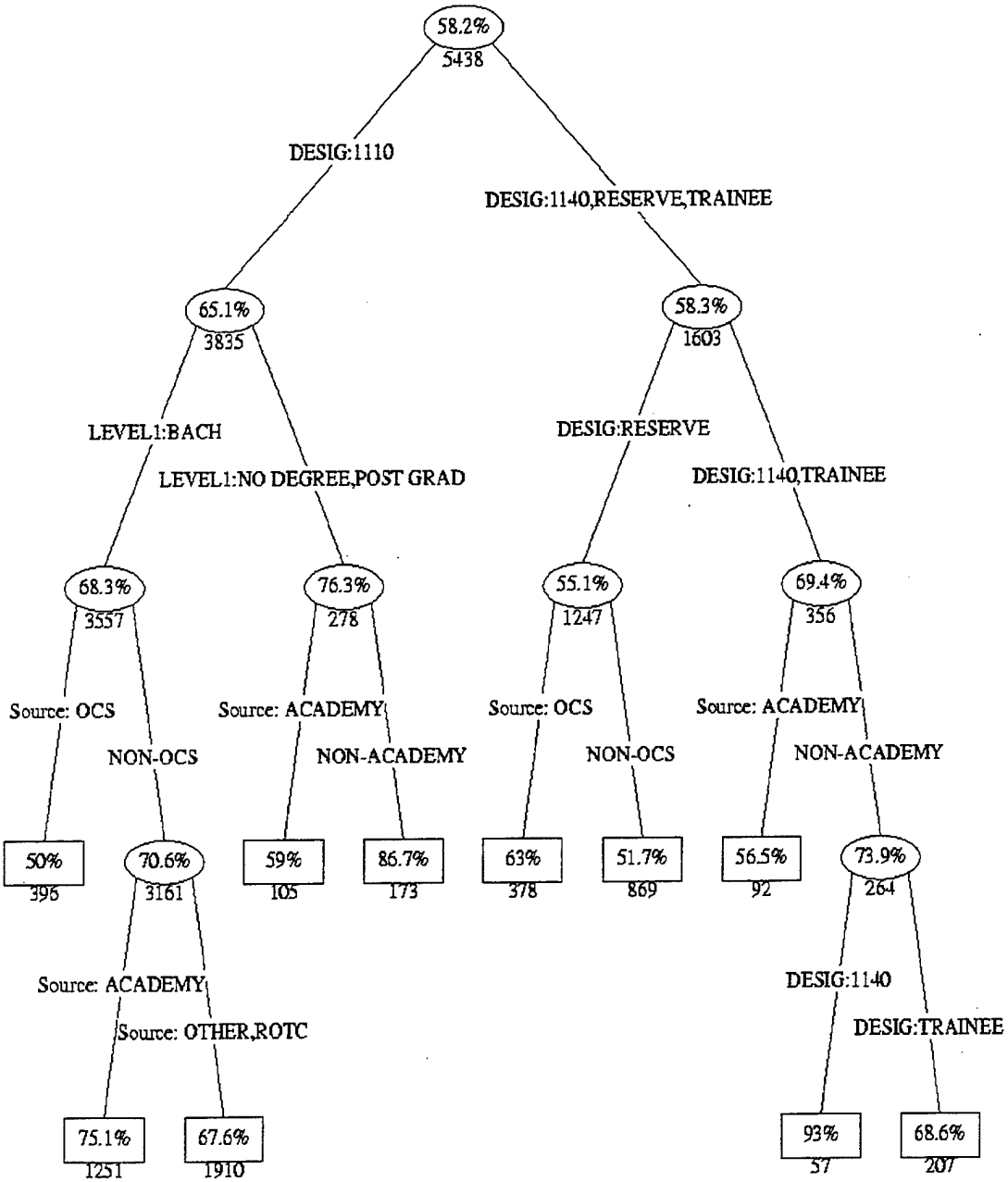

Figure 1: Classification and Regression Tree - OMF

The root shows a rate of 58.2 percent, which is the "stay" rate of the whole data set. Rectangular terminal nodes are called leaves. The first split divides the root into two sets: officers with designator 1110 versus officers with designator 1140, reserve designators and trainee designators. It is important to note the small number of records in the 1140 designation, 86. As an example of how to use the tree model, looking at the lower right side branch, there are 57 officers with designator 1140, or Trainee, and a source of commissioning from other than the Naval Academy who had a "stay" rate of 93 percent. This estimate becomes the probability of staying for future officers with these characteristics.

5. Predictive Power

As a goodness-of-fit check, a test of the models' predictive capability was made using each year's grouping of data. For example, those who stayed from 1991 until 1992 and those who left in 1991 were one grouping - 1991/1992. The naïve model claims that all officers will remain in service. When using the model, two types of errors result: Type I – predicting a member will leave when he or she actually stays; and Type II – predicting a member will stay when he or she, in fact, leaves. The results of the regression model and the tree model for each year group's prediction can be found in Tables 9 and 10, respectively.

Table 9: Regression Model Prediction Summary

Naïve Model	n	Actual Attrites	# Correct Predicted	Type I Errors		Type II Errors		Total Errors	
				#	%	#	%	#	%
1991/1992	375	116	259	0	0.0	116	30.9	116	30.9
1992/1993	803	185	618	0	0.0	185	23.0	185	23.0
1993/1994	2100	1556	544	0	0.0	1556	74.1	1556	74.1
1994/1995	418	122	296	0	0.0	122	29.2	122	29.2
1995/1996	555	105	450	0	0.0	105	18.9	105	18.9
1996/1997	604	104	500	0	0.0	104	17.2	104	17.2
1997/1998	610	91	519	0	0.0	91	14.9	91	14.9
Regression Model	**n**	**Actual Attrites**	**# Correct Predicted**	**Type I Errors**		**Type II Errors**		**Total Errors**	
				#	%	#	%	#	%
1991/1992	375	116	204	120	32.0	51	13.6	171	45.6
1992/1993	803	185	614	11	1.4	178	22.2	189	23.5
1993/1994	2100	1556	776	18	0.9	1306	62.2	1324	63.0
1994/1995	418	122	305	9	2.2	104	24.9	113	27.0
1995/1996	555	105	401	107	19.3	47	8.5	154	27.7
1996/1997	604	104	502	8	1.3	94	15.6	102	16.9
1997/1998	610	91	423	144	23.6	43	7.0	187	30.7

Table 10: Tree Model Prediction Summary

Naïve Model	n	Actual Attrites	# Correct Predicted	Type I Errors		Type II Errors		Total Errors	
				#	%	#	%	#	%
1991/1992	375	116	259	0	0.0	116	30.9	116	30.9
1992/1993	803	185	618	0	0.0	185	23.0	185	23.0
1993/1994	2100	1556	544	0	0.0	1556	74.1	1556	74.1
1994/1995	418	122	296	0	0.0	122	29.2	122	29.2
1995/1996	555	105	450	0	0.0	105	18.9	105	18.9
1996/1997	604	104	500	0	0.0	104	17.2	104	17.2
1997/1998	610	91	519	0	0.0	91	14.9	91	14.9
Tree Model	**n**	**Actual Attrites**	**# Correct Predicted**	**Type I Errors**		**Type II Errors**		**Total Errors**	
				#	%	#	%	#	%
1991/1992	375	116	239	103	27.5	33	8.8	136	36.3
1992/1993	803	185	596	139	17.3	68	8.5	207	25.8
1993/1994	2100	1556	1126	176	8.4	798	38.0	974	46.4
1994/1995	418	122	287	88	21.1	43	10.3	131	31.3
1995/1996	555	105	420	91	16.4	41	7.4	132	23.8
1996/1997	604	104	454	110	18.2	40	6.6	150	24.8
1997/1998	610	91	447	138	22.6	25	4.1	163	26.7

The tree model creates fewer Type II errors in each of the year groups. Although there may seem to be a large number of combined Type I and Type II errors in each model; when the cost factors are applied to the errors, both predictive models prove to be valuable. The cost of replacing a SWO Lieutenant is approximately $121,000 annually (Dye, 1998). This cost is associated with a Type II error – losing an officer who was

predicted to stay. The cost to keep a SWO Lieutenant – based on the survey results – would be a bonus of at least $10,000. The proposed bonus is for $50,000 (M. Dye, personal communication, March 1999). To bring a Lieutenant to the same point in a career at which another has left would be about five years. This cost is associated with a Type I error – keeping an officer who was predicted to leave. Applying these costs to the Type I and Type II errors results in Tables 11 and 12.

Table 11: Approximate Cost Summary of Regression Model Results ($M)

Naïve Model	Type I Errors*	Type II Errors**	Total Errors
1991/1992	$0.0	$14.0	$14.0
1992/1993	$0.0	$22.3	$22.3
1993/1994	$0.0	$187.9	$187.9
1994/1995	$0.0	$14.7	$14.7
1995/1996	$0.0	$12.7	$12.7
1996/1997	$0.0	$12.6	$12.6
1997/1998	$0.0	$11.0	$11.0
Regression Model	Type I Errors*	Type II Errors**	Total Errors
1991/1992	$1.2	$6.2	$7.4
1992/1993	$0.1	$21.5	$21.6
1993/1994	$0.2	$157.7	$157.9
1994/1995	$0.1	$12.6	$12.7
1995/1996	$1.1	$5.7	$6.7
1996/1997	$0.1	$11.4	$11.4
1997/1998	$1.4	$5.2	$6.6

*** - calculated using $10,000 per error. For example, the Regression model for 1991/1992 contained 120 Type I errors. 120 x $10,000 = $1,200,000.**
**** - calculated using $121,000 per error. For example, the Regression model for 1991/1992 contained 51 Type II errors. 51x $121,000= $6,170,0000**

Table 12: Approximate Cost Summary of Tree Model Results ($M)

Naïve Model	Type I Errors*	Type II Errors**	Total Errors
1991/1992	$0.0	$14.0	$14.0
1992/1993	$0.0	$22.3	$22.3
1993/1994	$0.0	$187.9	$187.9
1994/1995	$0.0	$14.7	$14.7
1995/1996	$0.0	$12.7	$12.7
1996/1997	$0.0	$12.6	$12.6
1997/1998	$0.0	$11.0	$11.0
Tree Model	Type I Errors*	Type II Errors**	Total Errors
1991/1992	$1.0	$4.0	$5.0
1992/1993	$1.4	$8.2	$9.6
1993/1994	$1.8	$96.4	$98.1
1994/1995	$0.9	$5.2	$6.1
1995/1996	$0.9	$5.0	$5.9
1996/1997	$1.1	$4.8	$5.9
1997/1998	$1.4	$3.0	$4.4

*** - calculated using $10,000 per error. For example, the Tree model for 1991/1992 contained 103 Type I errors. 103 x $10,000 = $1,030,000.**
**** - calculated using $121,000 per error. For example, the Tree model for 1991/1992 contained 33 Type II errors. 33x $121,000= $3,993,000**

Applying the dollar figures to the errors results in lower costs for both the regression and tree models than for the "naïve" model. Further, the tree model costs are lower than than the regression model costs because the tree model has fewer Type II errors. Assuming a Type II error is worse than a Type I error, the tree model is best because it has the lowest costs.

B. SURVEY DATABASE

The sample was limited to 77 non-deployed ships and the respective SWOs serving on those ships. Only 46 (60%) of the 77 ships that received packages responded

to the survey. Those ships had minimum officer complements of 13 to a maximum of 37. The numbers of officer responses per ship ranged from 2 to 11. Only 28 of the responding ships correctly identified their Unit Identification Code, which indicated approximately half of the respondents were on east coast based ships (57%) and the other half were from west coast ones (43%). Understandably, the results from the fleet survey are not considered a random sample, and consequently all statistics from it cannot be applied reliably to the rest of the population.

1. Descriptive Statistics

The majority, 222 of the 246 respondents (90%) were either O-1 or O-2. Many respondents, 99 (40%) were commissioned at the Naval Academy, 92 (37%) received commissions through Reserve Officer Training Corps (ROTC), 32 (13%) were commissioned after Officer Candidate School (OCS), and the remaining respondents, received their commissions from other sources. Of the ROTC graduates, 68 (69%) said they expected to remain in service for less than 7 years. Most respondents, 154 (63%) were 25 years of age or under, 74 (30%) were ages 26 through 30, 14 (6%) were between the ages of 31 and 35, and the remainder were 36 years of age or older. Of those respondents 30 years of age or under, 146 (59%) indicated that they expected to serve seven or fewer years.

This data was examined using a classification tree to determine if any of the resulting factors can be associated with factors found in the OMF logistic regression and classification tree presented earlier. The dependent variable was the number of years an officer expected to remain in service (EXPYRS). The categories were: fewer than 5 years (n=53; 22%), 5 or more years but fewer than 7 years (n= 93; 38%), 7 or more years

but fewer than 10 years (n=34; 14%), 10 or more years but less fewer 15 years (n=10; 4%), and 15 years or more (n=50; 20 %). There were few non-respondents (n=6; 2%).

2. Classification Tree

A classification tree was created using the expected years of service as the response variable and the remaining questions as the predictor variables. The classification tree first divided the group on age, then on source of commissioning. Figure 2 depicts this division. Using this breakdown, source of commissioning is the only category that appears in both this tree and the tree developed using the OMF database.

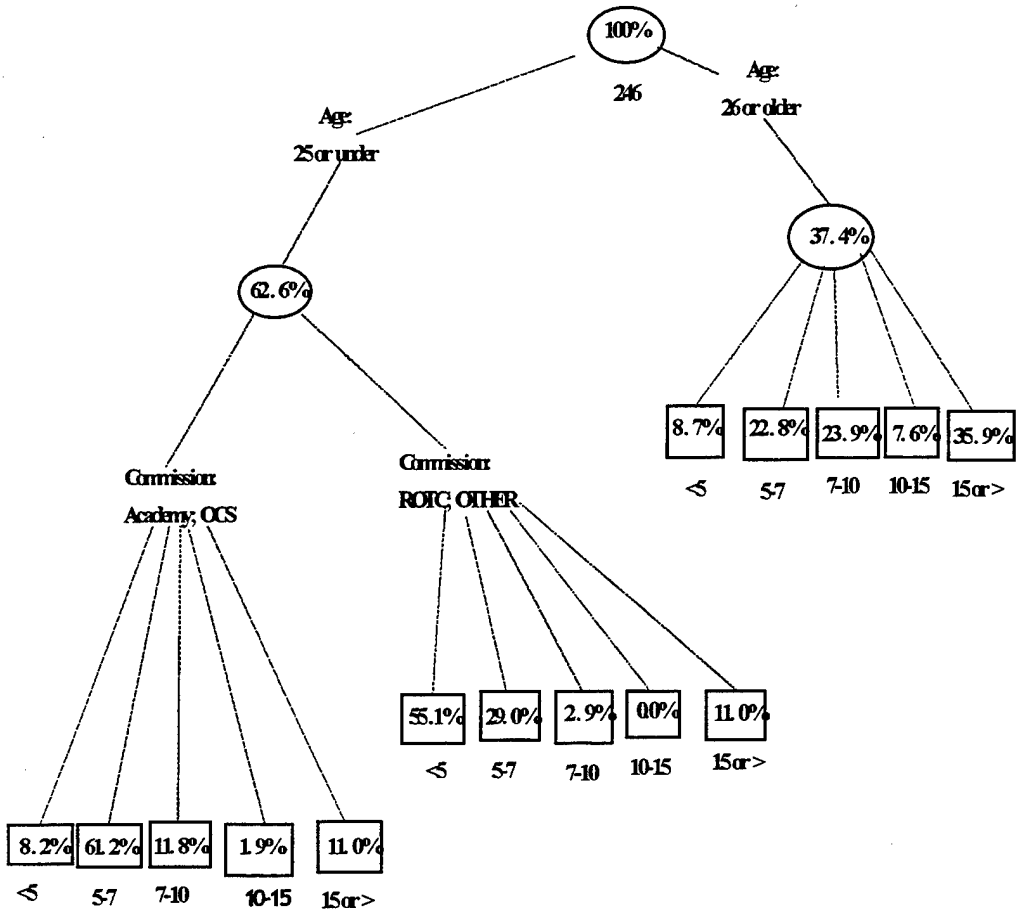

Figure 2: Classification Tree for Survey

With the source of commissioning variable as a link between the two databases, inferences will be made about three of the levels of this variable: Reserve Officer Training Corps (ROTC), Naval Academy (ACAD) and Officer Candidate School (OCS).

For the dependent variable EXPYRS, 129 (67%) for both ROTC and ACAD indicated that they would serve less than 7 years. Only 11 (34%) of the OCS graduates

said the same. Over 80 percent of each group believed they had excellent chances of being promoted to their next pay grade, and over 85 percent of each group believed they could find a good civilian job if they left the military now. Only 14 (15%) for ROTC and 23 (25%) for the Academy were concerned about long-term opportunities in the military while 17 (53%) of OCS graduates worried about the same. The majority (over 55 %) of each group agreed that life in the military was what they expected it to be.

The financial burden the member's family would feel should the member have to unexpectedly leave the military concerned about 48 (25%) of the ROTC and ACAD graduates but concerned 15 (47%) of the OCS graduates. Over 70 percent of each group expected that their pay and benefits would not keep up with inflation, 25 (78%) of the OCS respondents believed benefits are better now than they will be in the future, 65 (66%) of the Academy respondents and 53 (56%) of the ROTC respondents agreed. For the Academy, ROTC and OCS; 80 (81%), 79 (86%) and 29 (91%) respectively, believed their work was important and challenging, and 72 (73%), 66 (72%) and 25 (78%) respectively, believed they receive good support from their chain-of-command.

When the question of satisfaction with their current job is posed, however, the numbers drop slightly to 91 (48%) for ROTC and ACAD and 17 (53%) for OCS. Overall, satisfaction with the military way of life is low for ROTC and ACAD respondents at 2 (30%) and 34 (34%), respectively, but 18 (56%) for OCS respondents. Over 65 percent of each group would like to see a bonus similar to the bonus aviators receive; 60 (61%) of the ACAD graduates would like the high bonus, and 64 (69%) of the ROTC graduates would be enticed to stay in with a $10,000 or greater bonus.

V. DISCUSSION

A. SUMMARY

The findings of previous research support the contention that monetary factors are not the major determinant in an officer's decision of whether or not to stay in the military. An officer's concern about his or her long-term opportunities in the military was consistently pointed to these studies and was statistically significant whenever analyses were performed. In particular, the military's force drawdown has come to the fore as a major factor in turnover decisions. None of the military studies reviewed went beyond four years after an initial survey, therefore their ability to draw conclusions about long-term career intentions is somewhat questionable. Further, the personnel and survey data used does not capture events that occurred between the time of the survey and when the data were collected. It is more useful to determine at what point the officer decided to leave the service and what changed for him or her during that period. Intrinsic factors, which include satisfaction with current job, working conditions, coworkers, acquaintances and job performance, appear to be more important than extrinsic factors, which include promotion opportunity, job training, retirement benefits and pay (Marsh, 1989).

This thesis examined characteristics from personnel data in the Officer Master File to create a logistic regression model. These characteristics include: Designation, source of commissioning, dependent status, level of education, year group and race. The sample population consisted of Navy Lieutenants from 1990 through 1998 who have just completed their initial obligated service. A Pearson's χ^2 test for independence was performed on the binomial response variable, leave or stay, with each of the predictor

variables: designation, source of commissioning, dependent status, level of education, year group and race. This analysis showed dependence between the response variable and designation, source of commissioning, and level of education. There was insufficient evidence to determine that there is dependence between the response variable and dependent status, year group and race.

A logistic regression was run with "LEAVE" or "STAY" as the response variable. It was found that "stayers" were most often officers designated as reservists and trainees, as were officers commissioned through ROTC or OCS, and officers with any amount of postgraduate education. "Leavers" are most often characterized as 1110 designees from the Naval Academy with no dependents or a spouse only and non-Caucasian. A classification tree model used the same variables and found designation to be the strongest predictor. The tree predicted more accurately for designator 1140, reservists and trainees than it did for designator 1110.

In both statistical analyses, the "naïve" model proposed that all officers would stay in the military. With that in mind, the planner would be wrong, on average, 29.7 percent of the time. Utilizing this study's tree model, the planner would experience a Type II error, on average, 12.0 percent of the time. The 1993/1994 numbers are unusually large. This could be a result of a massive build-up for the Gulf War four years earlier and may not be indicative of peacetime retention. For this reason, the anomalous 1993/1994 data were removed, and the error rate dropped to 7.6 percent. The average size of the population of interest (less the 1993/1994 data) is 561 individuals, the average number of Type II errors using the tree model would be 42, and the number of Type I errors would be 112. Although this seems like a great many, when dollars are applied to

the tree model errors the cost totals approximately $6.2 million. In contrast, the cost of errors using no model is, on average, $14.6 million. This would be a savings of over $8 million per year for every 561 officers.

The survey data provided only one link, source of commissioning, whereas, the data in the OMF only indicate characteristics of the types of officers leaving service, not why they are leaving. Responses from 246 officers partitioned by source of commissioning provided some interesting points. They are not as concerned with their abilities to secure civilian employment. It is interesting to note that the guarantee of a choice location did not increase the likelihood of remaining in service. The majority of Academy graduates in the survey, 73 (74%), is not greatly concerned that there will be a financial burden on their family should they leave the military. Most, 54 (56%), agree that military life is what they expected it to be. They believe their military pay and benefits will not keep up with inflation and that retirement benefits will not be as good in the future. Skills learned in military are perceived as useful in securing a good military job.

This study showed that a large number, 79 (80%), of the Naval Academy group did not receive good support from superiors; however, 71 (72%) believed they were performing challenging work. They indicated that the military way of life was about what they expected it to be. Their major gripe was that they could do better in the civilian work place in both pay and benefits. A bonus of $10,000 or higher would have to be offered to entice them to stay.

B. CONCLUSIONS

The demographic data indicates that the proportion of officers with designators 1110, commissioned after OCS, are single, and have only a bachelors degree is higher for "leavers" than for the sample population. When an officer leaves the Academy, he or she is already designated as a regular Navy officer, so it is not surprising that a regular Navy SWO (1110) would have a higher likelihood of attrition. An officer commissioned after OCS does not have as much time invested in the organization as an officer commissioned through ROTC or the Naval Academy. Likewise, single officers can make major changes in their lives, such a leaving a job, and not affect any dependents.

The statistical techniques of both models found that a "stayer" is of designation 1140, reservist or trainee; commissioned from a source other than the Naval Academy; and has pursued an education beyond an undergraduate degree. The logistic regression model further states that the "stayer" has children and is Caucasian. In contrast, both models found a typical "leaver" to be of designation 1110, commissioned from the Naval Academy, and possessing an undergraduate degree. The logistic regression model further states the "leaver" has no dependents or only a spouse and is non-Caucasian.

An officer designated Regular Navy (1110) would leave for the same reason as the demographic data analysis uncovered: Academy accessions and, in the past, ROTC accessions were through the Regular Navy, and this constitutes the bulk of the officers in the sample population. The fact the model found an officer commissioned from the Naval Academy is more likely to attrite shows a sense of commitment is not instilled in these officers, and, in conjunction with the survey responses, may be an indication that the graduates feel a lack of commitment from the Navy. In addition, officers with no

dependents or only a spouse would be more likely to attrite because they have fewer responsibilities than do those officers with children. Race questions were not included on the survey, but the fact that the logistic regression model indicates that non-Caucasians leave at a higher rate may be an area for further study.

The logistic regression model found that officers with some postgraduate education were more likely to stay in the military. This area requires further study because only junior officers were included in the sample population; many have not yet had the time to pursue postgraduate work. Many of those who have pursued higher education have done so on their own time at a civilian institution during their first shore rotation. In fact, there are a number of billets for ROTC instructors at top civilian institutions, which provides a wonderful opportunity to pursue a higher education while performing one's military duties. For Academy graduates, the perception is that the good name of the Naval Academy, in concert with a big name civilian postgraduate degree, will afford a wider array of career opportunities outside of a military environment. The first opportunity to decide is as an O-3 right after their initial obligation.

In the event officers choose postgraduate education from a military institution, the additional obligated service associated with this education increases the likelihood that a military member will stay in until retirement. After completing the obligated service for receiving a postgraduate degree from a military institution, the officer likely has passed the 10 year point – a critical milestone in many officers' decisions to stay or leave – and he or she would be more likely to finish out service.

The survey data, although scant, suggests that quality of life issues are of great concern to the officers. While the officers indicated that they were satisfied with their

work environment, they indicated that they thought their pay and benefits would not keep up with the civilian community and that their overall satisfaction with a military lifestyle was low. Currently the government is fighting to improve the pay and benefits situation. Although this is a start, money is not the be-all-and-end-all solution to military woes.

Economic indicators were not used because they were available on a monthly basis while officer attrition was determined on a yearly basis. Factors affecting a decision to leave in January could have been different from factors affecting a decision to leave in July. This is somewhat disheartening since the "perceived" health of the economy would have a large impact on any decision affecting one's financial security – and one's career would certainly fall into the category of area of concern for financial security.

C. POLICY IMPLICATIONS

It is difficult for any model to predict retention for a single individual. Fortunately, the Navy is not interested in whether or not John Doe is staying in the Navy; the Navy is, however, interested in knowing what percentage of a group of individuals like John Doe will stay or leave. The fact that officers with few dependents are leaving at a higher rate than those with no dependents or only a spouse may indicate that quality of life that a military lifestyle provides is of great concern. The Surface Warfare Officer Community Manager's office believes that retention is affected by an attractive civilian economy, i.e., quality-of-life issues. The data available from the OMF is "clinical" at best. There is nothing to indicate the "feelings" of any group of officers regarding the civilian economy or a military lifestyle.

It is strongly recommended that cohort analysis be utilized to track these "feelings". Although the thought of filling out a survey can cause most people to blanche, it can be an extremely useful tool to gather the information necessary to monitor the effects of the less tangible factors such as economy and lifestyle satisfaction. Groups of officers need to be gauged at various stages in their careers. Reasons for satisfaction or dissatisfaction with the economy upon entering could be completely different than at the four-year point when the individual may have more dependents and the economy itself may have changed drastically. To track who left the service at different stages and what caused them to change their attitudes would be much more useful in establishing policy than simply categorizing individuals and inferring subjective motives from objective data. This survey data, in concert with the OMF data, may lend credence to all subjective inferences that can not be substantiated at this time.

The retention problem can not be rectified in a month nor even a year. Longevity studies and cohort analysis are what is needed to fully appreciate the discomfort felt by junior officers. Decision-makers need to know how certain officers "got through the tough times" during and after the actual experience. Labeling these officers as "whiners" is not going to endear them to the organization. Junior officers need to know their concerns are being addressed. Some individuals are going to stay in the military regardless of the monetary advantages because of pride and duty. Time with one's family is a great concern. Even in the civilian community, individuals have given up lucrative careers to spend more time with their families. A good paycheck may attract individuals to the Navy, but once there, something else has to entice them to stay because once that initial obligation is up, all other factors will still be present weighing on the

decision to stay or leave. If only money is addressed, it is likely that an officer will leave military service, and the Navy will be looking at the same crisis repeatedly for years to come.

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APPENDIX A. OMF DATA

Variable/Long Name	Description
DEPNPRI - Primary Dependency Code	Reflects the number and type of an officer's primary family members who are related to the officer. (lawful spouse, unmarried dependent children under the age of 21 or is incapable of self-support.)
DESIG - Designator	Identifies the category in which a officer is appointed and/or designated and the status of the officer within the category.
DOR - Date of Rank	YYMMDD of an officer's date of rank in his/her current grade.
DPLYDURA - Deployment Duration	Identifies the total number of months the officer has been deployed.
GEOLOC - Geographic Location	Identifies the geographic location of the Activity at which an officer is stationed.
GRDCURR - Current Grade	Identifies the grade in which an officer is presently serving unless he/she is serving in a Spot Promotion Grade.
INITMSRDT - Initial Minimum Service Date	YYMM - Year and Month for which the officer's initial obligation was complete.
LEVEL1 - Level of Education	Indicates the highest level of education the officer has received.
MSRCURR - Current Minimum Service Requirement Date	YYMM - Year and month in which the officer's current obligation is complete.
PlofBirth - Place of Birth	XX - two digit code indicating in which state or country an officer was born.
RACE - Race Code	Identifies an officer's race.
RETELGD - Retirement Eligibility Date	YY - Identifies the year in which an officer is eligible for retirement.
SEX - Sex Code	Identifies an officer as male or female.
SRCcdPGM - Current Source Code	Indicates the program under which an officer qualified for original appointment
SSN - Social Security Number	Identifies the officer's social security purposes.
YG - Precendence Year Group	Reflects the present precedence of an officer for promotional purposes. In most cases the year group generally corresponds to the fiscal year in which he/she was commissioned to Ensign.

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APPENDIX B. FLEET SURVEY

INDIVIDUAL CHARACTERISTICS:

This information in no way will be used to identify individuals. It is for statistical purposes only.

1. **Are you male or female?**

   [A] Male [B] Female

2. **How old were you on your last birthday?**

   [A] 25 or under [B] 26 - 30 [C] 31 - 35 [D] 36 - 42 [E] 43 or older

3. **As of today, what is the highest year of college for which you have completed and gotten credit ?**

   [A] Bachelor's degree [B] Some post graduate work [C] Graduate degree [D] Some doctoral work [E] doctoral degree

4. **What is your current marital status?** Mark only one.

   [A] Married [B] Widowed [C] Separated [D] Divorced [E] Never Married (GO TO Q 7)

5. **Is your spouse currently serving in the Armed Forces or in the Reserves/Guard?**

   [A] Yes [B] No

6. **Is your spouse currently living with you at your present permanent duty station?**

   [A] Yes [B] No

MILITARY INFORMATION:

7. **What is your pay grade?** Mark One

   [A] O-1/O-1E [B] O-2 /O-2E [C] O-3 /O-3E [D] O-4 [E] O-5 or above

8. **My designator is :**

   [A] 116X [B] 114X

9. **How many years do you have remaining on your military commitment?** Mark one.

   [A] <1 year [B] 1 or more but fewer than 2 [C] 2 or more but fewer than 3 [D] 3 or more but fewer than 4 [E] 4 years or more

10. **Through which of the following programs did you obtain your commission?** Mark one.

    [A] Academy graduate (USMA, USNA, etc.)
    [B] Officer Candidate School or Officer Training School
    [C] ROTC Scholarship
    [D] Reserve Officer Candidate
    [E] Other

11. Are you currently considering leaving the military?

[A] Yes [B] No

12. Have you ever considered leaving the military?

[A] Yes [B] No

13. Have you submitted your letter of resignation?

[A] Yes [B] No

14. Have you been looked at by a promotion board for advancement to your next pay grade?

[A] Yes [B] No

15. Have you been passed over by a promotion board for advancement to your next pay grade?

[A] Yes [B] No

PRESENT AND PAST LOCATIONS:

16. As of today, how many *months* do you have remaining at your present duty station? Please include any extensions you may have had.

[A] < 3 months [B]3 or more, but fewer than 12 [C] 12 or more, but fewer than 18 [D] 18 or fewer, but less than 24 [E] 24 months or more

17. As of today, what is the total time on your sea counter?

[A]< 6 months [B] 6 months or more but fewer than 1 year [C] 1 year or more but fewer than 3 [D] 3 or more but fewer than 4 [E] 5 or more

18. In all the time you've been on active duty, how many times did *you move* to a new location because of your permanent change of station (PCS)?

[A] 1 [B] 2 [C] 3 [D] 4 [E] 5 or more

***** If you are unmarried, go to question 21****

19. *In the past year*, how many months were you completely separated from your spouse or dependents because of your military assignment? Include TDYs, deployments, schools, etc.

[A] < 3 months [B] 3 - 6 [C] 6 -8 [D] 8 - 10 [E] 10 - 12

20. In your *total military career*, about how many years were you separated from your spouse or dependents because of your military assignments? Include TDY, deployment, etc.

[A] <1 year [B] 1 year or more but fewer than 2 [C] 2 or more but fewer than 3 [D] 3 or more but fewer than 4 [E] 4 years or more

CAREER INTENT:

21. When you finally leave the military, how many *total* years of service do you expect to have?

[A] < 5 [B] 5 or more but fewer than 7 [C] 7 or more but fewer than 10 [D] 10 or more but fewer than 15 [E] 15 years or more

22. When you finally leave the military, what pay grade do you think you will have? Mark one.

[A] O-3/O3E [B] O-4 [C] O-5 [D] O-6 [E] O-7 or above

23. When I finally leave the military, I plan to join a Reserve unit or the Coast Guard? Mark one.

[A] Definitely yes [B] Probably yes [C] Don't know/Not sure [D] Probably no [E] Definitely no

24. If you had the freedom to select another career field or leave the Service next month, which of the following would you choose? Mark one.

[A] Select a totally new military specialty/occupation

[B] Leave the service

[C] Remain in Service in current career field

[D] Return to previous military specialty/occupation

[E] Redesignation (ex. 1700 (Fleet Support) Community)

25. If I was *guaranteed a choice of location* for your next tour, I would remain in the Service. Assume that all special pays which you currently receive are still available. Mark one.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

26. My chances of being promoted to the next pay grade are good.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

27. My chances are of being promoted to general/flag officer during my career are good. Mark one.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

28. My spouse has no influence on my decision to stay in the military.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

29. My spouse's support for my decision to stay in the military has increased in the past year.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

30. My spouse and I agree on my career plans.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

MILITARY COMPENSATION, BENEFITS & PROGRAMS:

31. Does your spouse work?

[A] Yes [B] No [C] Not applicable

32. During the past 12 months, have you had a second job?

[A] Yes [B] No

** **If you answered "yes" to question 31 or question 32, indicate your agreement with the following statements. If you answered "no" to <u>both</u> question 31 and question 32, go to question 41.**

33. I/We needed additional income to meet basic expenses.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

34. I/We wanted to have extra income to spend <u>now</u>.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

35. I'm/We're saving extra income for <u>future</u> needs.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

36. I/My spouse work(s) for enjoyment, not for money.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

37. I wanted to gain experience for a non-military second career.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

38. Reasons not listed above contributed to having a second job/my spouse working.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

39. Military health benefits (including dental) are better than civilian benefits.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

40. My military retirement system is better than a civilian retirement system.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

41. In the past 12 months, have you received any job offers for a civilian job which you could take if you leave the military?

[A] Yes [B] No

42. Have you actively looked for civilian employment within the last six months?

[A] Yes [B] No

43. If I were to leave the military NOW, I am confident I would find a good civilian job.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

**** How concerned are you about the following as a result of the current talk about force reductions in the military?**

44. Your long-term opportunities in the military.

[A] Very greatly concerned [B] Greatly concerned [C] Moderately concerned [D] Somewhat concerned [E] Not at all concerned

45. The kind of work you plan to go into if you leave the military.

[A] Very greatly concerned [B] Greatly concerned [C] Moderately concerned [D] Somewhat concerned [E] Not at all concerned

46. Whether you will be able to get a civilian job quickly if needed.

[A] Very greatly concerned [B] Greatly concerned [C] Moderately concerned [D] Somewhat concerned [E] Not at all concerned

47. The financial burden on you and/or your family should you have to leave the military unexpectedly.

[A] Very greatly concerned [B] Greatly concerned [C] Moderately concerned [D] Somewhat concerned [E] Not at all concerned

48. Ability to adjust to civilian life.

[A] Very greatly concerned [B] Greatly concerned [C] Moderately concerned [D] Somewhat concerned [E] Not at all concerned

MILITARY LIFE:

**** How much do you agree or disagree with each of the following statements about military life?**

49. Life in the military is about what I expected it to be.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

50. Military personnel in the future will not have as good retirement benefits as I have now.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

51. My military pay and benefits will not keep up with inflation.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

52. Skills attained in my job are helpful in securing a good civilian job.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

53. My current job assignment is important work.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

54. My current job assignment is challenging work.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

55. My promotion opportunity is better than it would have been without this assignment.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

56. I receive good support from my chain-of-command.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

57. I receive good support from my supervisors.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

58. The major portion of my work hours is spent on duty-related tasks.

[A] Strongly agree [B] Agree [C] Neither agree nor disagree [D] Disagree [E] Strongly disagree

59. My family could be better off if I took a civilian job.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

60. Members of my family were well prepared by the Navy for the requirements and demands of my job.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

61. During the past year have the demands of your military job prevented you from taking annual leave?

[A] Yes [B] No

62. In general, how satisfied are you with your current job?

[A] Very satisfied [B] Satisfied [C] Neither satisfied nor dissatisfied [D] Dissatisfied [E] Very dissatisfied

63. Now taking all things together, how satisfied are you with the military way of life?

[A] Very satisfied [B] Satisfied [C] Neither satisfied nor dissatisfied [D] Dissatisfied [E] Very dissatisfied

**** Indicate your agreement with the following statement:**

64. A monetary bonus such as aviators receive would increase my chances of remaining in the military.

[A] Strongly Agree [B] Agree [C] No opinion/Does not apply [D] Disagree [E] Strongly Disagree

65. As an incentive to remain on active duty, a bonus would have to be at least:

[A] $5,000/ year [B] $7,500 per year [C] $10,000 / year [D] > $10,000 / year [E] Does not apply: I'm not leaving

**** Answer the final two questions if you are not leaving the service and you do not have a graduate school degree.**

66. What is your preferred means of obtaining a graduate degree while on active duty?

[A] a civilian institution

[B] a military-sponsored institution (i.e. Naval War College, Naval Postgraduate School)

[C] other

67. Would you be willing to take up to four (4) prerequisite courses at your current duty station before attending a military-sponsored graduate school?

[A] Yes [B] No

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APPENDIX C. DESCRIPTIVE STATISTICS

Table C.1: Categorical Variable Descriptive Statistics

Variable		Count	%
Designation	1110	3835	70.52%
	1140	86	1.58%
	Reservists	1247	22.93%
	Trainees	270	4.97%
Commissioning Source	USNA	1759	32.35%
	ROTC	968	17.80%
	OCS	261	4.80%
	Other	2450	45.05%
Dependent Status	No dependents	1493	27.45%
	Spouse	2132	39.21%
	Dependents	1813	33.34%
Level of Education	No undergraduate degree	15	0.28%
	Bachelor's degree	5112	94.01%
	Post Grad	311	5.72%
SEX	Male	5292	97.32%
	Female	146	2.68%
RACE	Caucasian	4780	87.90%
	Non-caucasian	658	12.10%

Table C.2: Continuous Variable Descriptive Statistics

Var	Min	1st Quartile	Median	Mean	3rd Quartile	Max
YG*	800.0	870.0	880.0	887.5	910.0	930.0

* Year Group (YG) was treated as a continuous variable to allow for predictions of officers from year groups not included in the model formulation.

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APPENDIX D. TREE MODEL OUTPUT

This appendix contains the S-Plus output for the classification tree pruned to 10 terminal nodes. Each row contains the node number, the node split, the number of observations in the node, the deviance at the node, the fitted value (TRUE for attrite, FALSE for non-attrite) and the estimated probabilities of the observations in that node not leaving, and leaving the Navy.

```
node), split, n, deviance, yval, (yprob)
      * denotes terminal node

 1) root 5438 7392.00 STAY ( 0.4182 0.58180 )
   2) DESIG:1110 3835 4963.00 STAY ( 0.3494 0.65060 )
     4) LEVEL1:BACH 3557 4444.00 STAY ( 0.3171 0.68290 )
       8) SRCcdPGM:OCS 396  549.00 LEAVE ( 0.5000 0.50000 ) *
       9) SRCcdPGM:ACAD,OTHER,ROTC 3161 3830.00 STAY ( 0.2942 0.70580 )
        18) SRCcdPGM:ACAD 1251 1405.00 STAY ( 0.2494 0.75060 ) *
        19) SRCcdPGM:OTHER,ROTC 1910 2405.00 STAY ( 0.3236 0.67640 ) *
     5) LEVEL1:NO DEGREE,POST GRAD 278  304.70 LEAVE ( 0.7626 0.23740 )
      10) SRCcdPGM:ACAD 105  142.10 LEAVE ( 0.5905 0.40950 ) *
      11) SRCcdPGM:OCS,OTHER,ROTC 173  135.60 LEAVE (0.8671 0.13290 ) *
   3) DESIG:1140,RESERVE,TRAINEE 1603 2178.00 LEAVE ( 0.5827 0.41730 )
     6) DESIG:RESERVE 1247 1716.00 LEAVE ( 0.5509 0.44910 )
      12) SRCcdPGM:OCS 378  498.30 LEAVE ( 0.6296 0.37040 ) *
      13) SRCcdPGM:ACAD,OTHER,ROTC 869 1204.00 LEAVE (0.5167 0.48330) *
     7) DESIG:1140,TRAINEE 356  438.60 LEAVE ( 0.6938 0.30620 )
      14) SRCcdPGM:ACAD 92  126.00 LEAVE ( 0.5652 0.43480 ) *
      15) SRCcdPGM:OCS,OTHER,ROTC 264  303.30 LEAVE ( 0.7386 0.26140 )
        30) DESIG:1140 57   28.97 LEAVE ( 0.9298 0.07018 ) *
        31) DESIG:TRAINEE 207  257.60 LEAVE ( 0.6860 0.31400 ) *
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